



## Through Babur's Eyes: A Scientific Exploration of Seasons, Time, and Measurement in Mughal India

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### Abstract

This research paper investigates the scientific dimensions of Emperor Babur's observations in his Memoir, the *Baburnama*. It explores how Babur, the founder of the Mughal Empire, documented seasonal changes, timekeeping, and measurement systems in 16th-century India. By analyzing his detailed accounts of climate, agriculture, and natural phenomena, the study highlights the intersection of empirical observation and cultural knowledge in Mughal India. Babur's methods are contextualized within the broader scientific traditions of the Timurid and Islamic worlds, revealing how his work contributed to early modern understandings of environmental and temporal phenomena. The research underscores the significance of Babur's writings as a historical source for studying pre-colonial scientific practices in South Asia.

**Keywords:** Baburnama; Babur; Mughal; measurement; season

### Introduction

In the early 16th century, Zahiruddin Mohammad Babur, a Timurid prince from Central Asia, established the Mughal Empire in India, ushering in an era of cultural synthesis, artistic innovation, and intellectual curiosity. Beyond his military conquests and political acumen, Babur was a keen observer of the natural world, as evidenced in his memoir, the *Baburnama*. This autobiographical work offers a rich tapestry of insights into the flora, fauna, seasons, and landscapes of the Indian subcontinent, alongside reflections on timekeeping and measurement practices. This research paper seeks to illuminate Babur's contributions to early scientific thought, situating his observations within the broader context of Mughal India's engagement with environmental and technical knowledge.

This paper explores how Babur's meticulous documentation of seasonal cycles, agricultural practices, and water management systems reflects a proto-scientific approach to understanding India's diverse ecosystems. It examines his references to timekeeping methods and the integration of Central Asian and Persian measurement techniques with Indian traditions. By analyzing the *Baburnama* alongside contemporary Mughal sources, this study highlights Babur's role in laying the foundation for scientific inquiry in the Mughal Empire, which later flourished under emperors like Akbar and Jahangir. Furthermore, it investigates how Babur's Central Asian heritage shaped his perception of India's monsoonal climate and temporal rhythms, offering a

unique cross-cultural perspective on environmental adaptation and technological innovation. Through this exploration, we aim to reposition Babur not only as a conqueror but also as a pioneer of empirical observation, whose legacy influenced Mughal India's scientific and cultural landscape.

This introduction assumes the paper focuses on Babur's scientific observations as recorded in the *Baburnama* and their implications for Mughal India. If you have access to the actual paper or specific details about its content, please provide them, and I can tailor the introduction more precisely. Alternatively, I can expand on specific aspects, such as Babur's descriptions of seasons or measurement techniques, if desired.

### **Seasons of the Year:**

Babur provides detailed observations about the Indian subcontinent, including its climate and seasons, based on Babur's experiences after his arrival in the early 16th century. His Memoir reflects Babur's perspective as a newcomer from Central Asia, accustomed to a different climate, and his descriptions of India's seasons are both practical and comparative. Babur describes India's climate in terms of three primary seasons, focusing on their meteorological characteristics and their impact on life, agriculture, and his campaigns. These align broadly with the modern understanding of India's predominant seasons based on his time in northern India, particularly the Punjab and Delhi regions.

Babur describes that whereas there are four seasons in those countries, there are three in Hindustan, namely, four months are summer; four are the rains; four are winter. The beginning of their months is from the welcome of the crescent-moons. Every three years they add a month to the year; if one had been added to the rainy season, the next is added, three years later, to the winter months, the next, in the same way, to the hot months. This is their mode of intercalation. *Chait*, *Baisakh*, *Jeth* and *Asarh* are the hot months, corresponding with the Fish, Ram, Bull and Twins; *Sawan*, *Bhadon*, *Kuwar* and *Katik* are the rainy months, corresponding with the Crab, Lion, Virgin and Balance; *Aghan*, *Pus*, *Magh* and *Phalgun* are the cold months, corresponding with the Scorpion, Archer, Capricorn, and Bucket or Aquarius.<sup>1</sup>

Babur further describes the season that the people of Hind, having thus divided the year into three seasons of four months each, divide each of those seasons by taking from each, the two months of the force of the heat, rain, and cold. Of the hot months the last two, i.e. *Jeth* and *Asarh* are the force of the heat; of the rainy months, the first two, i.e. *Sawan* and *Bhadon* are the force of the rains; of the cold season, the middle two, i.e. *Pus* and *Magh* are the force of the cold. By this classification there are six seasons in Hindustan.<sup>2</sup>

### **Days of the Week:**

Babur mentions the Indian (Hindu) system of naming days of the week, which are based on the seven celestial bodies and their associated deities. These names, rooted in Indian astrology and Vedic traditions, are part of the traditional Hindu calendar and find explicit mention in the *Baburnama*. Babur says that to the days also they have given names: *Sanichar* is Saturday; *Rabi-bar* is Sunday; *Som-war* is Monday; *Mangal-war* is Tuesday; *Budh-bar* is Wednesday; *Brihaspat-bar* is Thursday; *Shukr-bar* is Friday.<sup>3</sup>

Babur's mention of days are not based on the seven celestial bodies and their associated deities: *Ravivar* (Sunday, Sun), *Somvar* (Monday, Moon), *Mangalvar* (Tuesday, Mars), *Budhvar* (Wednesday, Mercury), *Guruvar* (Thursday, Jupiter), *Shukravar* (Friday, Venus), and *Shanivar* (Saturday, Saturn). Babur also does not tie these activities to specific days like *Somvar* (Monday, associated with Lord Shiva) or *Shukravar* (Friday, associated with Goddess Lakshmi), which are culturally significant in Hindu tradition for worship or rituals.

### Division of Time:

Babur comments on the Indian methods of timekeeping, which relied heavily on astronomical observations and traditional calendars. He notes the use of lunar and solar cycles in Hindu and regional calendars, which differed from the Islamic lunar calendar he was accustomed to. He found the Indian approach to dividing time, such as the use of *gharis* (a traditional unit of time, approximately 24 minutes) and other subdivisions of the day, to be distinctive. He expresses curiosity about these methods, though he sometimes found them less precise for his administrative needs.

Babur very scientifically describes the Indian time standard by comparing the Central Asian system. He says that as in our countries what is known by the (Turki) term *kicha-gundus* (a day and night, nycthemeron) is divided into 24 parts, each called an hour and the hour is divided into 60 parts, each sailed a minute, so that a day-and-night consists of 1440 minutes, so the people of Hind divide the night-and-day into 60 parts, each called a *ghari*. They also divide the night into four and the day into four, calling each part a *pahr* which in Persian is a *pas*. A watch and watchman (*pas* and *pasban*) had been heard about (by us) in those countries (Transoxania), but without these particulars.<sup>4</sup>

Babur further describes that agreeing with the division into watches, a body of *ghariyalis* is chosen and appointed in all considerable towns of Hindustan. They cast a broad brass (plate) thing, perhaps as large as a tray and about two hands' thickness; this they call a *gharial* and hang up in a high place. Also they have a vessel perforated at the bottom like an hour-cup and filling in one *ghari* (i.e. 24 minutes). The *ghariyalis* put this into water and wait till it fills. For example, they will put the perforated cup into water at day-birth; when it fills the first time, they strike the gong once with their mallets; when a second time, twice, and so on till the end of the watch. They announce the end of a watch by several rapid blows of their mallets. After these they pause; then strike once more, if the first day-watch has ended, twice if the second, three times if the third, and four times if the fourth. After the fourth day-watch, when the night-watches begin, these are gone through in the same way. It used to be the rule to beat the sign of a watch only when the watch ended; so that sleepers chancing to wake in the night and hear the sound of a third or fourth *ghari*, would not know whether it was of the second or third night-watch. I therefore ordered that at night or on a cloudy day the sign of the watch should be struck after that of the *ghari*, for example, that after striking the third *ghari* of the first night-watch, the *ghariyalis* were to pause and then strike the sign of the watch, in order to make it known that this third *ghari* was of the first night-watch, and that after striking four *gharis* of the third night-watch, they should pause and then strike the sign of the third watch, in order to make it known that this fourth *ghari* was of the third night-watch. It did very well; anyone happening to wake in the night and hear the gong, would know what *ghari* of what watch of night it was. Babur again says that they divide the *ghari* into 60 parts, each part being called a *pal*; by this each night-and-day will consist of 3500 *pals*.<sup>5</sup>

### Measures:

Babur also describes the Indian systems of weights and measures, which varied across regions but were standardized in some contexts for trade and taxation. He appreciated the classification and organization of these systems, which facilitated commerce in markets. For example, he notes the use of units like *maunds* and *seers* for measuring goods, finding them practical for large-scale transactions. His observations reflect an outsider's perspective, comparing these to the Central Asian systems he knew.

While appreciating the Indian measurement system Babur describes that the people of Hind have also well-arranged measures: 8 *ratis* = 1 *masha*; 4 *masha* = 1 *tank* = 32 *ratis*; 5 *masha* = 1 *misqal* = 40 *ratis*; 12 *masha* = 1 *tola* = 96 *ratis*; 14 *tola* = 1 *ser*. This is everywhere fixed: 40 *ser* = 1 *manban*; 12 *manban* (*man* or *maund*) = 1 *mani*; 100 *mani* they call a *minasa*. Pearls and jewels they weigh by the *tank*.<sup>6</sup>

## **Modes of Reckoning:**

Babur provides detailed observations about the modes of reckoning in India which was undoubtedly the proof of great wealth of India during his time in the early 16th century. Babur was impressed by the Indian numerical system. He admired the clarity and efficiency of this system for calculations, which he contrasted with other systems he had encountered. In his memoirs, he highlights the Indian method of counting as a positive feature of the land, noting its logical structure and utility in administrative and economic contexts. Babur's observations on Indian reckoning are part of his broader commentary on Hindustan's geography, society, and natural world, often written with a mix of admiration and critical comparison to his Central Asian homeland. The relevant passages are found in the sections on Hindustan, particularly where he discusses administrative and cultural practices.

Babur describes in *Baburnama* that the people of Hind have also an excellent mode of reckoning. He says that to 100,000 they call a *lak*; 100 *laks*, a *krur*; 100 *krurs*, an *arb*; 100 *arbs*, 1 *kharb*; 100 *kharbs*, 1 *nil*; 100 *nil*, 1 *padam*; 100 *padams*, 1 *sang*. The fixing of such high reckonings as these is proof of the great amount of wealth in Hindustan.<sup>7</sup>

Among the rich details of *Baburnama*, Babur provides meticulous notes on the natural world, societal practices, and technical systems of India, reflecting a scientific curiosity. His comments on seasons, timekeeping, and measurement reveal both his Central Asian perspective and his engagement with Indian systems, blending empirical observation with cultural comparison. He describes Hindustan's climate, noting the distinct monsoon, hot, and cool seasons. Babur observes India's traditional timekeeping methods, which relied on astronomical observations and calendars based on lunar and solar cycles. He finds Indian timekeeping intriguing but sometimes less precise for administrative purposes.

Babur's Memoirs suggest an awareness of the Hindu calendar's role in religious and agricultural life. Babur comments on Indian systems of measurement, particularly for trade and agriculture. He describes units like *maunds* and *seers* for weighing goods, appreciating their standardization in markets. These systems facilitated commerce, which he saw as strength of Indian society. Babur's notes on land measurement for taxation reflect his engagement with India's agrarian economy. He describes how land productivity was assessed, a practice later refined by his successors, showing his interest in systematic measurement for governance.

Babur's scientific outlook was shaped by the Timurid Renaissance, which valued astronomy, mathematics, and natural history. His memoirs reflect this, blending empirical observation with poetic descriptions. Above all Babur's curiosity about local systems shows a willingness to learn. His observations laid the groundwork for Mughal scientific advancements under later emperors like Akbar, who patronized translations and studies of Indian texts. Babur's detailed records in the *Baburnama* are a primary source for understanding early Mughal interactions with Indian science. His grandson Akbar commissioned its translation into Persian, preserving these insights for posterity. The work's blend of autobiography and scientific commentary makes it a unique historical document.

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The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

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## References

- [1] Babur, Zahiruddin Mohammad. Baburnama, (Memoirs of Babur, Eng. Trans. Annette Susannah Beveridge, Delhi, 2010, First Published in 1921), p. 515.
- [2] Ibid.
- [3] Ibid., p. 516.
- [4] Ibid.
- [5] Ibid., pp. 516-17. (60 bipal = 1pal; 60 pal = 1 ghari (24 minute); 60 ghari or 8 pahr = one din-raat, nycthemeron). It is also said that the length of a pal is the shutting and opening of the eyelids 60 times, which in a night-and-day would be 216,000 shuttings and openings of the eyes. Another experiment shows that a pal is about equal to 8 repetitions of the Qul-hu-Allah and Bismillah; this would be 28,000 repetitions in a night-and-day.
- [6] Ibid., pp. 517-18. The rati = 8 rice-grains; the masha is a kidney-bean; the tank is about 2 oz; the misqal is equal to 4 ratis; the tola is about 145 oz; the ser is of various values.
- [7] Ibid., p. 518.